DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

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RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT APPLICATION NO. 8152-2, City of Lake Andes

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Environment and Natural Resources concerning Water Permit Application No. 8152-3, City of Lake Andes, c/o Debbra Houseman, Finance Officer, PO Box 783, Lake Andes SD 57356.

The Chief Engineer is recommending APPROVAL of Application No. 8152-3 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing rights, 3) the proposed use is a beneficial use and 4) it is in the public interest with the following qualifications:

1. The well approved under this Permit will be located near domestic wells and other wells which may obtain water from the same aquifer. The well owner under this Permit shall control his withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.

2. The well authorized by Permit No. 8152-3 shall be constructed by a licensed well driller and construction of the well and installation of the pump shall comply with Water Management Board Well Construction Rules, Chapter 74:02:04 with the well casing pressure grouted (bottom to top) pursuant to Section 74:02:04:28.

3. The City of Lake Andes is responsible to monitor the Park Avenue water level and control the well. The well shall be capable of being shut in and no discharge from the well is authorized when the Park Avenue lake level is above 1436.5 feet mean sea level as measured.

4. A permanent benchmark or landmark shall be established for the purpose of referencing when Park Avenue lakes water level elevation is at 1,436.5 feet mean sea level equating to a surface impoundment area of 18.9 acres. The location of the benchmark or landmark shall be described and identified on a map by direction and distance from a section corner. The survey notes, map and description of the benchmark or landmark will be held by the Water Rights Program.

See report on application for additional information.

Jeanne Goodman, Chief Engineer
July 6, 2015

NOTE: The well must be constructed so that the city can completely shut in the well to prohibit it from flowing. This will require constructing the well with a flowing well pitless unit so the well can be completely shut in during winter months. DENR encourages the city to discuss installation of the flowing well pitless unit with the well driller prior to construction of the well.

REPORT TO THE CHIEF ENGINEER
ON
WATER PERMIT APPLICATION NO. 8152-3
CITY OF LAKE ANDES
JUNE 24, 2015

Water Permit No. 8152-3 proposes to appropriate water from a well completed into the Dakota aquifer, approximately 800 feet deep, at a maximum diversion rate of 0.17 cubic feet of water per second (cfs). The well is to be located in the NE¼ NE¼ Sec. 9, T96N-R65W. Water from the well will be used for recreational use to maintain the water level in the Park Avenue Lake Restoration Project.

The Park Avenue Lake Restoration Project involves constructing a dike around Lake Andes in the southwest portion of the lake, and creating an artificial impound. The surface area of the proposed artificial impoundment is expected to be 18.9 acres. Spuhler and others, (1971) estimated an average annual lake evaporation rate for this area of approximately 38 inches per year. Therefore, evaporation from the pond will be approximately 59.85 acre-feet annually. The proposed well discharge into the impoundment of 0.17 cfs would equate to an annual rate of 123.07 acre-feet per year. A well discharge of 0.17 cfs for the eight months a year when the pond is not frozen would result in 82.05 acre-feet of water.

AQUIFER: Dakota aquifer (DKOT)

AQUIFER CHARACTERISTICS:
The Dakota aquifer consists of the permeable beds of sand and sandstone contained in the Cretaceous aged Dakota Formation. The lithology of the Dakota Formation is quite variable both laterally and vertically, consisting of interbedded sand, sandstone, and shale. It has been postulated the explanation for this is that the Dakota was deposited in a fluvial environment. The porosity of the Dakota varies with the lithology but is assumed to average 15 %, and the specific yield of the aquifer is assumed to be 0.075 (Hedges and others, 1982). Over large areas of the eastern part of State, the Dakota Formation can be subdivided into three units: an upper unit consisting of light-brown to reddish-brown, fine-to medium-grained, friable, sandstone that is interbedded with gray to dark-gray shale and thin, discontinuous beds of lignite; a middle unit consisting of a gray silty clay; and a lower unit consisting of medium-to coarse-grained quartz sandstone (Schoon, 1971).

"The Dakota sandstone is the most widely extended and serviceable water-bearing formation in South Dakota and it is the principal source of artesian flow in the many wells." (Darton, 1909) The Dakota Formation underlies approximately 66,500 square miles of the 77,047 total square miles that constitute the State (Schoon, 1971). The total recoverable water in storage in the Dakota Formation in eastern South Dakota is estimated to be 381,104,000 acre-feet of water (Hedges and others, 1982). The Dakota-Newcastle Formation contains another 308,442,000 acre-feet of recoverable water in storage in western South Dakota (Allen and others, 1985).

In the area of this proposed project, the Dakota Formation is overlain by the Graneros Shale, and it overlies the Skull Creek Shale. The Dakota Formation is expected to be approximately 300

feet thick in this area (Schoon, 1971). The potentiometric surface of the aquifer is expected to be approximately 1,535 feet above mean sea level elevation (Kume, 1977), (i.e. approximately 43 psi shut in pressure).

SDCL 46-2A-9:
South Dakota Codified Law (SDCL) 46-2A-9 requires "A permit to appropriate water may be issued only if there is reasonable probability that there is unappropriated water available for the applicant's proposed use, that the proposed diversion can be developed without unlawful impairment of existing rights and that the proposed use is a beneficial use and in the public interest."

Water Availability:
The probability of unappropriated water available from an aquifer can be evaluated by considering SDCL 46-6-3.1 which requires "No application to appropriate groundwater may be approved if, according to the best information reasonably available, it is probable that the quantity of water withdrawn annually from a groundwater source will exceed the quantity of the average estimated annual recharge of water to the groundwater source." If the source of the water is older or lower than the Greenhorn Formation and a water distribution system has applied for a permit, the Board need not consider the recharge/withdrawal issue. Although there is an exception to the recharge/withdrawal consideration in SDCL 46-6-3.1, it applies only to applications filed by water distribution systems and is not applicable here.

Water Permit Application No. 8152-3 proposes to divert water from a well completed into the Dakota aquifer, at a maximum diversion rate of 0.17 cfs. If approved, the amount of water that can be diverted annually through this water permit would be limited only by the diversion rate, and in theory, the permit would appropriate approximately 123 acre-feet of water annually.

Data is not available to compare the average annual recharge to the Dakota aquifer with the average annual withdrawal from the aquifer. Since the early 1900's there has been concern in regard to the declining artesian head of the Dakota Formation. This artesian pressure decline has been well documented, and in some parts of the state, water levels have declined several hundred feet since the aquifer was first developed. Some have interpreted this declining pressure as an indicator that the Dakota is being "mined". As Schoon (1971) states: "The fact that withdrawal from the artesian system exceeds recharge is clearly demonstrated by declining pressures." Water level records in parts of the state indicate this decline is continuing and is in the range of one foot per year or less.

In general, the artesian pressure of the Dakota aquifer has been declining in this area (Kume, 1977). The decline of head pressure in the area can be seen in the hydrograph for DENR-Water Rights' Observation Well AU-89A, which is located approximately 32 miles north of the well site proposed by this application, is shown in Figure 1.

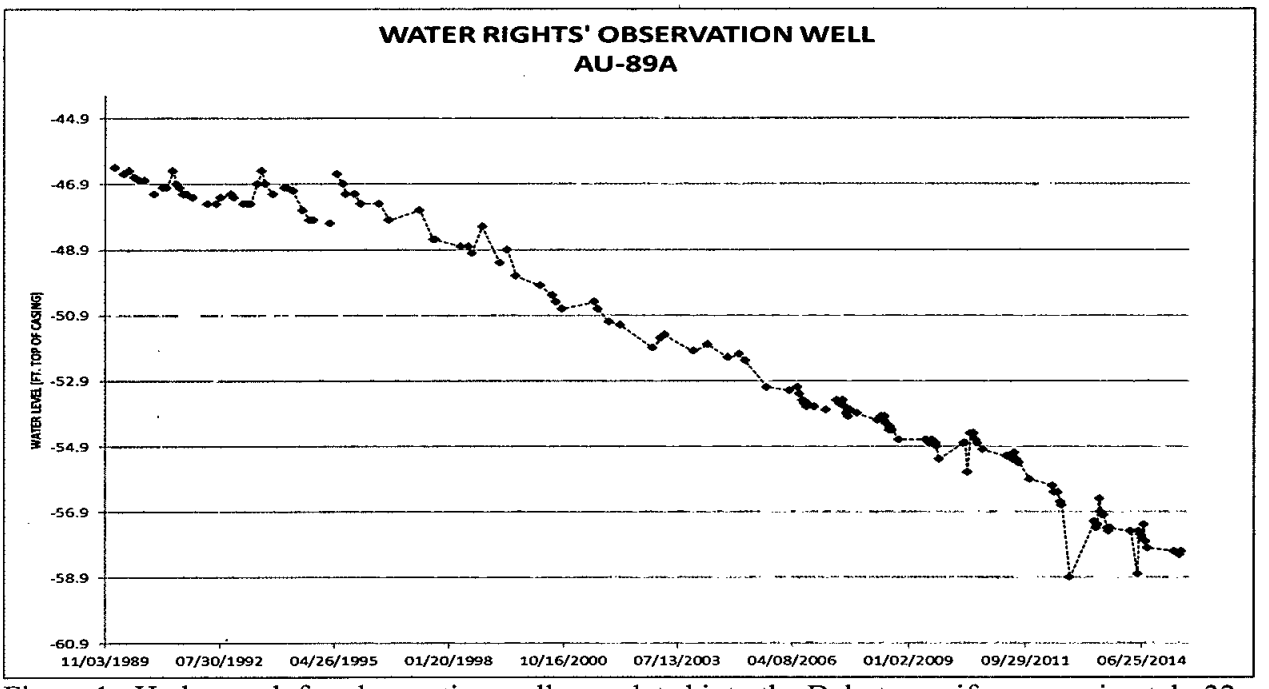


Figure 1. Hydrograph for observation well completed into the Dakota aquifer approximately 32 miles north of the well site proposed by this application.

Historically, the Water Management Board has carefully considered the issue of declining pressures in the Dakota aquifer and the lack of average annual recharge estimates for the aquifer. The Board concluded that whether withdrawals exceed the average annual recharge cannot be determined based solely upon a decline in head pressure, and in theory the Dakota aquifer head pressure is stabilizing relative to withdrawals and discharges. The Board found that the decline of head pressure is due to water being discharged without beneficial use through uncontrolled flowing wells and that water discharged from uncontrolled flowing wells does not constitute withdrawal (appropriation) pursuant to SDCL 46-6-3.1. The Board also found that withdrawals pursuant to SDCL 46-6-3.1 are appropriations for beneficial uses of water, including withdrawals through private domestic wells for domestic use (Water Rights, 1987).

Existing Water Rights:

Water Rights/Permits appropriating water from the Dakota aquifer within approximately 20 miles of the well site proposed by this application are shown in Figure 2 and Table 1. In addition to the appropriative rights, there are a number of domestic wells on file with the DENR-Water Rights Program in this area that appear to be completed into the Dakota aquifer (Water Rights, 2015c). The nearest well completed into the Dakota aquifer that is authorized by a water right/permit (Water Right No. 220-3, US Fish/Wildlife Service), is located approximately four and one-half miles east of this proposed well site. The Dakota aquifer is confined and under artesian conditions in this area and drawdown resulting from the withdrawal proposed by this application may extend some distance from a production well. The distance between the well proposed by this application and the well authorized by Water Right No. 220-3 is sufficient that well interference is not expected to be adverse at the diversion rate proposed by this application (i.e. 0.17 cfs). It is possible, however, that drawdown from this appropriation, if it is approved, may be measurable in existing wells.

Wells supplying existing water rights/permits and domestic uses are protected from adverse impacts per Water Management Board rules 74:02:04 and 74:02:05, which were promulgated pursuant to SDCL 46-6-6.1. These rules provide for the regulation of large capacity wells to the degree necessary to maintain an adequate depth of water for a prior appropriator in wells that have the ability to produce water **independent of artesian pressure.** Simply put, the pump placement in a prior appropriator's well is not necessarily protected.

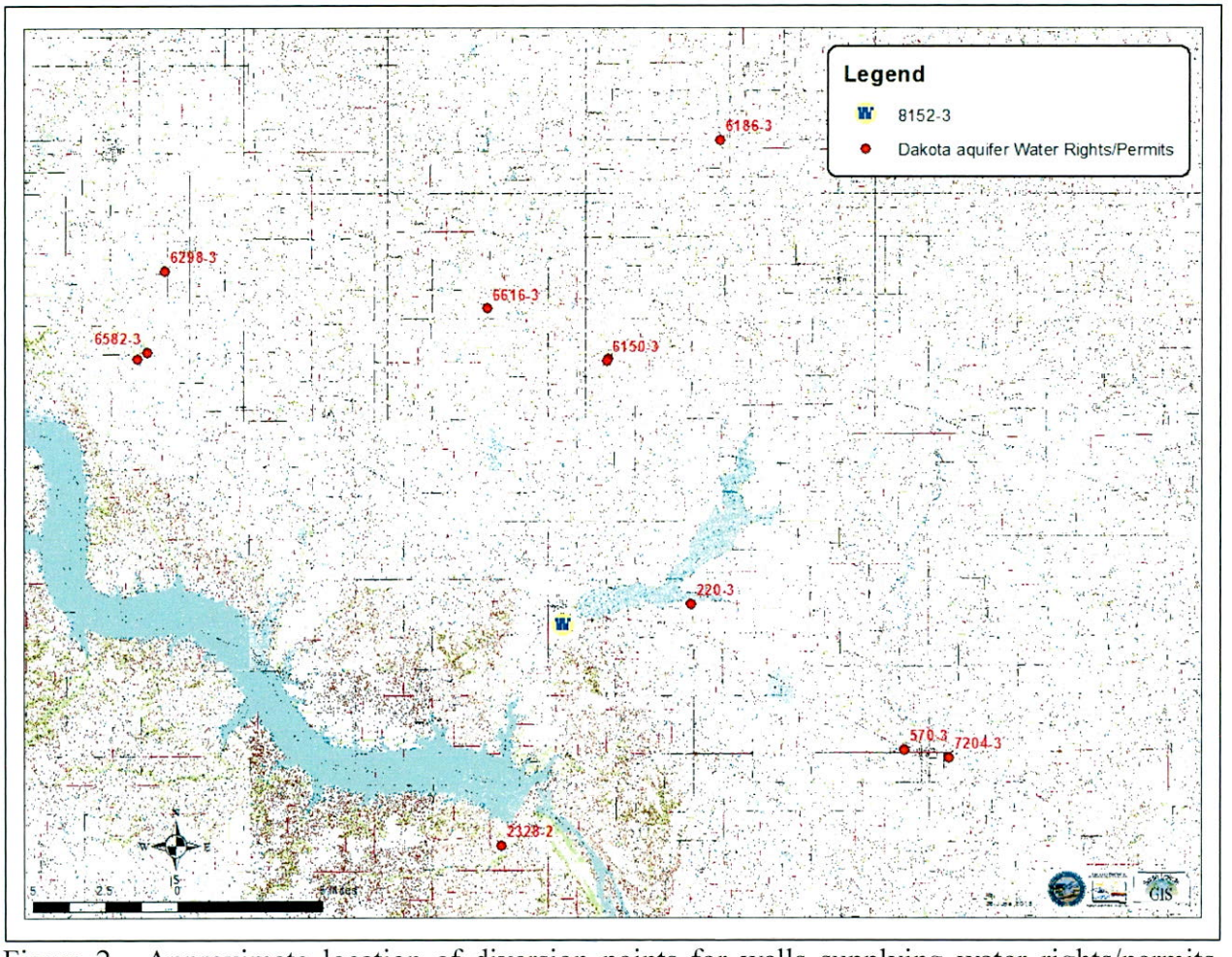


Figure 2. Approximate location of diversion points for wells supplying water rights/permits appropriating water from the Dakota aquifer in the vicinity of the well site proposed by Application No. 8152-3.

If the water levels in the Dakota aquifer were to decline, owners of existing wells bear the responsibility of lowering the pump inlet in the well to the top of the aquifer, if necessary. Increased lift would decrease the pump discharge; or require a larger pump or a different type of a pump to maintain the same output.

An increase in operating expenses that may result from interference between wells is not necessarily an adverse impact. The Water Management Board considered this situation in the

matter of Water Permit Application 2313-2, Coca-Cola Bottling Company of the Black Hills (Water Rights, 1995). The Board adopted findings of fact and conclusions of law that basically state that if the increased cost or decreased production is considered an adverse impact, it could be in conflict with SDCL 46-1-4, which requires South Dakota's water resources to be put to beneficial use to the fullest extent of which they are capable.

Table 1. Water rights/permits appropriating water from the Dakota aquifer in the vicinity of the well site proposed by Application No. 8152-3.

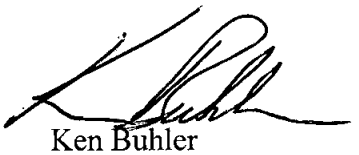
PERMIT NO	NAME	PRIORITY DATE	STATUS	USE	CFS
220-3	US FISH/WILDLIFE SERVICE	07/06/1956	LC	FWP	2.22
570-3	CITY OF WAGNER	01/01/1933	LC	MUN/REC	0.55
2328-2	MICHAEL KIRWAN	02/21/1995	LC	IRR (31 acres)	0.22
6150-3	RED ROCK COOP ASSOC	08/25/1999	LC	COM/LCO	0.333
6186-3	B & B WASHOUT	03/07/2000	LC	COM	0.111
6298-3	COYOTE RIDGE COOPERATIVE	02/07/2002	PE	COM/LCO	0.1
6582-3	DEHAAN LIVESTOCK & GRAIN	02/01/2005	PE	COM/LCO	0.156
6616-3	ARMOUR HUNTERS HAVEN LLP	03/28/2005	PE	FWP/REC	0.22
7204-3	STEVEN FOUSEK	06/02/2010	PE	COM/GEO	0.133

LC= Water Right, PE= Water Permit, FWP= Fish and Wildlife Propagation, MUN= Municipal, REC= Recreational, IRR= Irrigation, COM= Commercial, LCO= Large Confinement Operation, GEO= Geothermal

CONCLUSIONS:

1. Water Permit Application No. 8152-3 proposes to appropriate water from the Dakota aquifer at a diversion rate of 0.17 cfs to maintain the water level in Park Avenue Lake Restoration Project.
2. The artificial impound proposed by the applicant will result in an evaporation loss of approximately 60 acre-feet of water annually.
3. The diversion rate proposed by this application exceeds the evaporation losses of the pond that is to be maintained.
4. To ensure this permit, if approved, does not result in a waste of water, the City of Lake Andes is responsible to shut in the well to ensure no discharge occurs if the stage of Park Avenue lake is above 1436.5 feet msl.
5. Water levels in the Dakota aquifer have declined in many parts of the State since the first wells were completed into the aquifer.
6. The Water Management Board has concluded that whether withdrawals exceed average annual recharge cannot be determined based solely upon a decline in head pressure.
7. The potentiometric surface of the Dakota aquifer has declined primarily as a result of the waste of water from uncontrolled flowing wells.
8. The Water Management Board has concluded that in reference to SDCL 46-6-3.1, "withdrawals" applies only to water placed to beneficial use via appropriations or domestic use.

9. The Water Management Board's position has been to optimize development for beneficial use from the Dakota aquifer.
10. There is a reasonable probability that existing water rights/permits will not be adversely impacted if this application is approved.



Ken Buhler
SD DENR-Water Rights Program

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